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REVIEWS AND ABSTRACTS OF LITERATURE

L'Année Psychologique. Fondée par ALFRED BINET. Publiée par HENRI PIÉRON. 19th year. Paris: Masson et Cie. 1913. Pp. 515.

The new editor, in a brief preface, pays a tribute to the memory of the founder, and restates the purpose of the *Année*, which will contain, as in the past, original works, especially those from the psychological laboratory of the Sorbonne, and analyses and critical reviews of the literature. The editor contributes two of the original articles, and nearly two hundred of the reviews.

Piéron's first article is a general survey of the "Le domaine psychologique" (pp. 1-26), in which he treats, rather sketchily, but judiciously, of the present state and prospects of psychology on its various sides. His reaction to the "behavior psychology" is interesting. He readily accepts the definition of psychology as the science of behavior, and holds that it is an objective science. Nevertheless he is not disposed to reject the introspective method, and does not believe that the use of this method is antagonistic to the objectivity of the science. He says: "There is a certain trait in human behavior, revealed by aid of language, which consists in being interested in mental functions and in observing them while they are functioning. . . . It is quite probable that introspection presupposes the existence of consciousness in the individual who devotes himself to it; but, for the psychologist who collects introspective reports, they have the same objectivity as meteorological documents, though the recording instruments may not be equally trustworthy." The generalizations of modern introspective psychology are based on a plurality of objective documents, and no longer on the mere subjective impressions of the psychologist. But, he adds, "introspection is not a universal necessity, and, above all, it is not necessary in order to comprehend what is studied by other methods. The assertion is often made that one could not make experiments on memory unless one knew from internal experience what memory was. Nothing is more false: one can study auditory images without possessing such images, or colored hearing without being able to understand what the 'color of a vowel' can mean. A deaf individual can study hearing, a color-blind individual can study the color sense."

Piéron's second article, "Experimental Studies on the Phenomena of Memory" (pp. 91-193), brings together results from two quite different sources—verbal memory in man, and adaptation to a repeated sensory stimulus in invertebrates—and finds so many correspondences as to indicate that the process is fundamentally the same in the two cases.

The experiments on man consisted mostly in the learning of "letter-squares" composed of 25, 50, or 72 numbers. The animal experiments were done with gastropods, which react to a sudden darkening of the aquarium by withdrawing into their shells, but cease to make this protective reaction after the stimulus has been repeated several times at short intervals. Experiments were made on (1) the effect of distributed learn-

ing; (2) on the curve of acquisition; and (3) on the curve of forgetting. Under the first head, there is introduced a valuable variant of a well-known experiment of Jost. Instead of keeping the interval between learning periods constant, while varying the duration of the learning periods, he keeps the duration of the learning period constant and varies the interval between them. Thus, with human subjects, a square of numbers was read once at each learning period, and the free interval between learning periods was varied, in different experiments, from 30 seconds to 48 hours. Intervals of one half to two minutes were distinctly less favorable than longer intervals; and five minutes seemed to be slightly less favorable than ten. From 10 minutes to 24 hours, the change was very slight, while 48 hours was perhaps slightly less favorable. There is, accordingly, an optimum interval, though it is not sharply limited. Piéron interprets this result in terms of the familiar theory of the ripening or consolidation of associations.

The question of an optimum interval was also asked in experiments on gastropods, in the following form: How many stimuli (darkenings of the aquarium) must be presented at a given interval, in order that the resulting adaptation shall last a defined time (as 10 seconds) after the cessation of the stimuli? There was an optimum interval, though it was much shorter (less than a minute) than in human learning.

In his studies of the curve of acquisition, Piéron is particularly interested in examining whether, as asserted by Charles Henry, this curve is essentially different according as a memory or a habit is being acquired. By comparing the learning of a list of numbers with the practise curve in stenography and typewriting, he comes to the conclusion that there is no clearly marked difference.

In studying the curve of forgetting, he points out a peculiar condition of the well-known experiments of Ebbinghaus, namely, that the subject learned several series of syllables in immediate succession, and thus hastened the process of forgetting. In some experiments of his own, Piéron had only one series learned at a time, and tested its retention after an interval in which no other memorizing had been done. He thus gets a much slower loss of memory, and, in fact, he gets a curve of forgetting which, while having the general character of the Ebbinghaus curve, requires a somewhat different equation. This curve and equation he also finds applicable to the disappearance of the adaptation effect in gastropods, though the absolute rate of forgetting is much more rapid with them.

Finally, the author considers the striking similarity between the curve of the development and evanescence of a sensation and the curve of formation and disappearance of a memory trace, and reaches the conclusion that the two processes, though running a similar course, are distinct. The curve of sensation runs a very rapid course, and has already come down to zero before the upward sweep of formation of an association has reached its maximum. Consequently, the memory trace can not be interpreted as a residue of sensation. What is called "primary memory," or the "memory after image," is, however, a sensorial persistence, to be distinguished from memory proper.

There are two other papers on memory. Heymans discusses the "two memories of Bergson" (pp. 66-74), the one active, motor, and at bottom physical, the other passive, imaginal, and purely spiritual. The former is exemplified by remembering a lesson which has been learned by several repetitions; it is identical with habit. The latter is exemplified by the revival of a momentary experience, as of a single one of the readings by which the lesson was learned. Heymans does not accept this distinction, but holds that what remains in the remembered lesson, after several readings, is what is common to these several experiences, what is dissimilar having disappeared by mutual inhibition. "In fine, it appears to me that the memory image is nothing but a nascent habit, and a habit nothing but the memory image fixed by repetition, and isolated from its changing circumstances."

Foucault studies the influence of the length of a series of words to be learned on the time of learning and on retention (pp. 218-235). He is here working on familiar ground, in the hope of fixing the relations more precisely than has been done hitherto. He finds the following law closely followed by his own results and by others in the literature: the time for continuous learning increases as the square of the number of words in the series. Time is here a representative of work. The law breaks down for very short series, where memory proper does not come into play, and for series so long as to bring on fatigue before they are learned. In regard to retention, it has long been known that a longer series is retained better than a short, when each is learned just to the point of correct recitation. His results on this point, not very extensive, to be sure, can be formulated by saying that the proportion forgotten is inversely proportional to the length of the list.

The author of this paper makes some interesting remarks regarding the attitude which should be taken towards such mathematical formulations of facts. He rejects the attitude now in vogue of regarding them as mere empirical approximations, and holds that the slight divergences that are sure to appear between observed and calculated values are due to the complication of conditions, and not to any fundamental incapacity of mathematical thought to get to the bottom of things. If the latter were the case, it would, he believes, be impossible to explain how mathematical formulæ can prove to be approximately correct.

Foucault also contributes an article on "The most general laws of mental activity" (pp. 75-90). He first raises the question of the measurability of mental work. To be measured a magnitude must be homogeneous and continuous, conditions which are at first thought not realized in mental performances. But the condition of homogeneity can be met by providing suitable material for work, as has been accomplished notably in memory experiments; and the rhythmic regularity of work in performing a series of similar tasks is a satisfactory substitute for continuity. Accordingly, mental work can be measured under experimental conditions. The first law of mental work is that when it is directed to a constant end, and performed under constant conditions, the time consumed can be taken as a measure of the work. The validity of this measure is

indicated by the approximate constancy of the time required to accomplish the same task. Some variation, however, always remains, and the second and third laws are concerned with the variability of time in the repeated performance of the same or equivalent tasks. The variability increases with the intellectuality or "quality" of the work, and decreases, relatively and very slightly, with the quantity.

Boquet writes on "The investigations of astronomers on the decimal equation" (pp. 27-65). The decimal equation is akin to the personal equation, and was first noticed by the astronomers Hartmann and Pierce. When the fraction of the unit of a scale has to be estimated in tenths, the several tenths are not recorded with equal frequency, as they should be in the long run, but in certain proportions which are characteristic of the individual observer. The following table gives the frequency per thousand observations of the records for each tenth by three astronomical observers:

Tenths	0	1	2	3	4	5	6	7	8	9
1st observer	113	105	193	111	36	44	29	58	185	125
2d observer	250	77	103	61	114	85	47	74	95	94
3d observer	169	78	132	81	50	58	57	113	141	121

The observers differ considerably, but each observer is found to give nearly the same proportions in different sets of 1,000 observations. The decimal equation appears in various sorts of measurement, and a similar phenomenon appears when the division is into fifths instead of tenths. There are also individual peculiarities or "equations" in bisecting a line or space. A genuine psychological explanation has not been reached, but the formulation of Pierce still seems to fit the facts; according to this, the observer makes use in all such estimations of a "personal scale" which is more or less distorted.

Rabaud gives experimental and statistical evidence against the existence of an "Instinct of Isolation in Insects" (pp. 194-217). It is true that in a single ripe nut or acorn no more than a single larva is usually found, but this isolation does not result from any instinct on the mother's part to avoid nuts in which an egg has already been laid. In some cases, the small number of females as compared with the number of nuts makes it improbable that more than one egg shall get deposited in the same nut, and a count shows that the number of nuts receiving two eggs is about what is demanded by probability. In other cases, where the number of females is comparatively large, it frequently happens that more than one egg is deposited in the same nut, and more than one larva develops, each one at first being enclosed in a cavity of its own making. As these cavities become larger and coalesce, the two larvæ proceed to fight, until one is driven out or killed. In these cases the isolation is secondary. The fighting instinct which results in this secondary isolation can hardly be regarded as directed towards isolation, since it occurs also in species other than endoparasites.

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